A-9923
PATENT APPLICATION

Title: A DEVICE FOR MOUNTING A COMPONENT SUCH AS A PIPE ON A STUD

Inventor: Hideki KANIE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of copending Application No. _____ filed July 23, 2003 (Attorney Docket A-9906), and claims the benefit of Japanese Patent Application No. 2002-272668 filed September 19, 2002, and Japanese Patent Application No. 2002-224620 filed August 1, 2002, both incorporated herein by reference.

BACKGROUND OF THE INVENTION

This invention relates to a device for mounting components, such as pipes, on a stud.

Prior devices for attaching a component to a threaded stud, welded to the body of an automobile, for example, have a bore into which the stud is inserted to engage pawls that fasten the device to the stud. In one such device, the orientation of the pawls in the bore is fixed, which

restricts insertion of the stud into the bore to a single direction.

Japanese Unexamined Patent Application Publication No. 9-159061 discloses a device for attaching a component to a stud, in which the stud can be inserted into a bore from either end. Flexible fingers having thread-engaging protrusions bend from hinge sections when a stud is inserted into the bore. However the fingers are bent nearly 90° from the hinge sections, and as a result a large insertion force is required to insert the stud. Also, because the retention force is limited by the thin sections, the attachment of the device to the stud is weak.

The invention of the above-cited copending application permits the easy insertion of a stud into the bore of an attachment device from either direction and is capable of a secure attachment. One embodiment disclosed in the above-identified copending application, has a pair of pawls, but as mentioned in that application, the number of pawls is not limited to two.

Figs. 1A and 1B show a two-pawl embodiment of the copending application. Fig. 1A shows a situation in which a stud 30 is inserted into the bore of the attachment

device with some lateral deviation between the axis of the stud and the axis of the bore, while Fig. 1B shows a situation in which there is little or no deviation. In Fig. 1A, the two pawls 7 are oriented asymmetrically with respect to the stud, so that the extent of engagement of the pawls with the threads 31 of the stud (A in one case and B in the other case) is unequal, and slippage between the stud and the pawls is more likely to occur than in the situation shown in Fig. 1B, where the pawls 7 are equally engaged with the threads 31 of the stud (i.e., A=B). Indeed, in Fig. 1A the pawl 7 at the left of the figure has become almost ineffective in restraining the slippage of the attachment device along the stud 30.

BRIEF DESCRIPTION OF THE INVENTION

The present invention makes use of only a single pawl in a manner that minimizes slippage.

An object of the present invention is to provide a device for mounting a component on a stud, in which the stud can be inserted into a bore of the device from either end, with a small insertion force, and in which a single pawl provides attachment of the device to the stud that is strong and reliable.

Briefly stated, an embodiment of a device according to the present invention employs a single pawl having a thick section extending from a thin section forming a hinge that connects the pawl to a wall of the bore. Thread engaging sections for engaging the threads of the stud are formed at an end of the thick section of the pawl. One of the engaging sections engages threads of the stud by insertion in a space between crests of the threads of the stud when the stud is inserted in the bore from one direction, and the other engaging section similarly engages threads of the stud when the stud is inserted in the bore from the opposite direction. Grooves are formed on the pawl near respective engaging sections for accommodating one of the thread crests. One of the grooves is used when the stud is inserted into the bore from one direction, and the other groove is used when the stud is inserted into the bore from the opposite direction.

The invention will be further described in conjunction with the accompanying drawings, which illustrate a preferred (best mode) embodiment of the invention, and wherein:

Figs. 1A and 1B are sectional views of a two-pawl device;

Fig. 2A is a plan view of a single-pawl device according to the invention;

Fig. 2B is a side view of the single-pawl device;

Fig. 2C is a plan view of the single-pawl device as seen from a direction opposite to that of Fig. 2A;

Fig. 2D is a fragmentary sectional view taken along line A-A in Fig. 2A;

Fig. 2E is an enlarged sectional view of a portion designated in Fig. 2D by a circle C;

Fig. 3 is an enlarged fragmentary sectional view showing engagement of the pawl with threads of the stud;

Figs. 4A and 4B are diagrammatic plan views illustrating the extent to which lateral movement of a stud in a bore can occur in a single-pawl device (Fig. 4A) and in a two-pawl device (Fig. 4B);

Fig. 5 is a sectional view showing a device of the invention with a stud inserted into a bore of the device from one end; and

Fig. 6 is a sectional view showing a device of the invention with a stud inserted into the bore from the opposite end.

DETAILED DESCRIPTION OF THE INVENTION

An embodiment of the invention shown in Figs. 2A-2E, 3, 5 and 6 of the drawings comprises a device 1 having a main body section 2 and a component mounting section 20 for attaching a component such as a pipe or dash silencer to a threaded stud 30. In the form shown, the upper and lower surfaces of the main body section 2 are nearly flat, and dish shaped recesses 3 and 4 are formed in the upper and lower surfaces to accommodate a widened base of the stud. A bore is formed in the main body section 2. The stud 30 is inserted into the bore from either end to attach the device 1 to the stud.

A single pawl 7 extends from an inner wall 5 of the bore of the main body section 2 substantially perpendicular to the axis of the bore, as shown in Figs. 2D and 2E.

As shown in Fig. 2E, adjacent to the inner wall 5 of the bore, the pawl 7 has a flexible thin section 8 forming a hinge that permits the pawl 7 to bend from the thin section 8 in either axial direction of the bore. The thin section 8 supports a thick section 9, which, in the form shown, is nearly flat on its side surfaces facing the ends of the bore. The thick section 9 is more rigid and more difficult to bend than the thin section 8.

Thread engaging sections 10a,b are formed at the end of the thick section 9 to engage threads 31 on the stud 30. Engaging section 10a is formed at one side of the pawl 7, and engaging section 10b is formed at the opposite side. As shown in Figs. 2A and 2C, the tips of the engaging sections 10a,b of pawl 7 are arcuate so as to conform to the curvature of the threads 31.

As shown in Fig. 2E, a threading groove 11a is formed near engaging section 10a, and a threading groove 11b is formed near engaging section 10b. As shown in Fig. 3, when an engaging section (e.g., 10b) engages threads of the stud 30, it enters a space between successive crests of the threads and one of the crests is received by one of the grooves (e.g., 11b). The threading grooves 11a,b keep crests of the threads from coming into contact with the sides of thick section 9 and allow the engaging sections to approach the root of the threads. The threading grooves 11a,b are arcuate so as to conform to the curvature of the threads 31.

As shown in Figs. 2A, 2C, 2D, there is an inner wall 6 of the bore that extends around the circumference of the bore except for the location of an inner wall 5 to which the pawl 7 is attached by the thin section 8. The radius

of inner wall 6 is smaller than the radius of inner wall 5. The inner diameter of inner wall 6 is slightly larger than the outer diameter of the stud 30. Because there is only a single pawl 7, the inner wall 6 can, to a major extent, closely surround the stud. Because there is only a slight space between the inner wall 6 and the stud 30, there can be only a little lateral movement of the stud 30 in the bore, as set forth later.

The component mounting section 20 is used to mount a component such as a pipe. In this example, recesses 21 (see Fig. 2B) are formed in the component mounting section 20 to accommodate the pipes. Resilient retainers 22 formed in the component mounting section 20 hold the components in the mounting section. Hollow sections 23 may be formed below the recesses 21 to reduce the weight of the device.

Fig. 3 shows the pawl 7 when the device 1 has been mounted on a stud 30. Before the device is mounted on the stud, the centerline D of the pawl 7 extends in a direction substantially perpendicular to the axis of the bore. See the dotted line position of pawl 7. When the stud 30 is inserted into the bore from one end, the pawl 7 is pressed against threads 31 of the stud 30 and bends toward the opposite end of the bore. When the device 1 has been

mounted on the stud, the centerline of the pawl 7 extends in a direction that forms an angle ß substantially less than 90° with respect to the initial direction of the centerline D of the pawl 7 before mounting.

In the form shown in Fig. 3, the length of the thick section 9 of the pawl 7 is B. Also, the distance between the inner wall 5 and the stud 30 is A. The length B of the thick section 9 of the pawl 7 is a constant substantially greater than A. If the difference between B and A were small, the device 1 would tend to come off the stud 30.

Figs. 4A and 4B are simplified diagrams showing, comparatively, the extent to which lateral movement of the stud in the bore can occur in single-pawl and two-pawl devices. Fig. 4A shows the extent E of lateral movement along a direction between pawl 7 and an opposite wall 6 (referred to as a first direction) when there is only a single pawl 7, as in an embodiment of the present invention. Fig. 4B shows the extent F of lateral movement along the same first direction when there are two pawls 7, as shown in an embodiment in the aforementioned copending application.

In Fig. 4B, the inner wall 6 is discontinuous on opposite sides of the bore where the pawls 7 are mounted. As a result, there is a possibility of significant lateral movement of stud 30 in the first direction between the pawls, with consequences discussed earlier in connection with Fig. 1A. In Fig. 4A the inner wall 6 is continuous except where the single pawl 7 is mounted, and the pawl presses the stud 30 against the inner wall 6 at the side of the bore opposite to the pawl 7. As a result, there can be very little movement of the stud in the first direction between the pawl and the inner wall 6.

As is apparent in Fig. 4B, sections of the inner wall 6 restrict lateral movement of the stud 30 in the bore in a second direction orthogonal to the first direction. In the single-pawl embodiment of Fig. 4A, such movement of the stud in the bore is similarly restricted.

In the example shown in Fig. 4A, the difference between dimension G (width of wall 5 at the base of pawl 7) and dimension H (distance between the ends of inner wall 6) is made as small as possible. As a result, the circumference of the stud is closely surrounded by the inner wall 6 except where the pawl is mounted, and the inner wall 6 extends circumferentially around the stud to

an extent that is sufficient to restrict lateral movement of the stud in the bore in the first direction.

Fig. 5 is a cross-sectional view showing the device 1 in an embodiment of the present invention mounted on a stud 30 in one direction. The position of the pawl 7 before mounting is indicated by the dotted lines, and the position of the pawl 7 after mounting is indicated by the solid lines. When the stud 30 is inserted into the bore in the device 1, the pawl 7 is bent at the thin section and moves along the threads 31 of the stud 30. At the mounting position, the engaging section 10b on the pawl 7 and the threading groove 11b engage the threads 31 on the stud 30, and the device 1 is secured to the stud 30.

Components 40 such as pipes can be attached to the component mounting section 20 before the device 1 is mounted on the stud 30, or after the device 1 has been mounted on the stud 30.

Fig. 6 is a cross-sectional view of the device 1 mounted on a stud 30 in the opposite direction. When the stud 30 is inserted into the bore in the device 1, the pawl 7 is bent at the thin section in the direction opposite to that shown in Fig. 5 and moves along the threads 31 of the stud 30. At the mounting position, the engaging section

10a on the pawl 7 and the threading groove 11a engage threads 31 on the stud 30, and the device 1 is secured to the stud 30.

Again, components 40 such as pipes can be attached to the component mounting section 20 before the device 1 is mounted on the stud 30, or after the device 1 has been mounted on the stud 30.

The device in this embodiment of the present invention can be mounted on a stud from either direction and has the same mounting properties in both directions. Because the device has only a single pawl, a stud can be inserted into a bore of the device with little force, and when the stud is inserted, the pawl achieves an effective angle in the bore that does not vary. The arcuate threading grooves on the pawl assist the arcuate engaging sections of the pawl in engaging threads of a stud securely. By virtue of the fact that an inner wall of the bore closely surrounds the stud except for a region where the pawl is mounted, the amount of slippage of the stud in the bore is minimized, and the device of the invention can be reliably attached to a stud with a stable retention force.

While a preferred embodiment of the invention has been shown and described, it will be apparent that changes can

be made without departing from the principles and spirit of the invention, the scope of which is defined in the accompanying claims. For example, while a preferred embodiment of the invention has an inner wall 6 that is continuous, the inner wall 6 might be somewhat discontinuous so long as it provides the lateral movement restricting functions of the continuous inner wall 6 shown in Fig. 4A.